

REMARKS

No amendments are made to the present application. Pending in the application are claims 1-45, 47-64 and 66-70, of which claims 1, 9, 20, 22, 29, 42, 64, 66, 67 and 70 are independent. Claims 2-8, 22-41, 49-54, 59, 60 and 67-69 are withdrawn from consideration. The following comments address all stated grounds for rejection and place the presently pending claims, as identified above, in condition for allowance.

35 U.S.C. §103 REJECTIONS

In the Office Action, the Examiner rejects claims 1, 9-21, 42-45, 47, 48, 55-58, 61-64, 66 and 70 under 35 U.S.C. §103. Applicants traverse the rejection and submit that the pending claims distinguish patentably over the cited references.

Definition of Co-Planar

In the “Response to Arguments” section of the Office Action, the Examiner indicates that the recitation “co-planar” includes a meniscus with any portion lying in the same plane as an interface port in a channel side wall, and that such a co-planar meniscus is inherently disclosed in the Heller reference, the McCormick reference and the Amigo reference. Applicants maintain that the recitation “co-planar” denotes that the meniscus plane is the same as the side wall plane, such that the meniscus aligns with the side wall edges. The co-planar plane of the meniscus is equal to, not a subset of, the co-planar plane of the side wall. Were the Examiner’s definition is correct, the use of the term “co-planar” in the claims would be redundant and non-limiting, as the meniscus already must be located along the length of the channel side wall according to the claim language, without specifying that the meniscus is “co-planar”. Therefore, the recitation co-planar should be interpreted as requiring meniscus edges to align with edges of a side wall, such that the meniscus is substantially flush with the side wall at both ends, thereby *replacing* the entirety of the removed portion of the side wall.

Obviousness Rejections over Heller, McCormick, Amigo, Howitz, Columbus (4,302,313), Bjornson et al., Columbus (4,426,456), Kopf-Sill, Swierkowski, Sundberg and/or Swedberg

Applicants maintain that the combinations of the Heller reference, the McCormick reference, the Amigo reference, the Howitz reference, the Columbus ‘313 reference, the

Columbus '456 reference, the Bjornson reference, the Kopf-Sill reference, the Swierkowski reference, the Swedberg reference and/or the Sundberg reference fail to render the claims obvious. As set forth in the Response to the Office Action dated June 12, 2006, Applicants assert that the claims distinguish patentably over the cited references. First, the cited references, even in combination, fail to disclose or make obvious the recitations in the claims. Second, motivation to combine the references is lacking.

The cited references, alone or in combination, fail to disclose a fluid interface port forming a virtual wall that **replaces** a *removed* portion of a side wall, or a meniscus surface that is co-planar with a side wall of a channel. As previously set forth, the term “co-planar” requires that the meniscus surface substantially align with the edges of the side wall, so that the overall effect of the virtual wall meniscus and the opening in the side wall is substantially zero. Such a feature is not disclosed in or obvious from any of the cited references.

In addition, the independent claims specify that the dead volume of the virtual wall in the fluid interface port is less than one picoliter (substantially zero). Because the cited references require a larger dead volume in an injection region in order to properly operate, this recitation is not only not disclosed in the cited references, but also not obvious from the teachings of these references. For example, the Heller reference discusses the advantages of an *enlarged* application area A in terms of sample loading accuracy in column 5, lines 32-35, which teaches *away* from a fluid interface port having minimal size and dead volume, which could provide decreased loading accuracy due to the small size.

In addition, Heller teaches that the cover for the channels may be a film, which precludes formation of a fluid interface port in a side wall defining a channel (see column 6, lines 1-2), as recited in the claims.

In addition, the Howitz reference, in the sixth paragraph of the specification (column 1), specifies that “the length of each individual microcapillary is to be selected such that the target fluid will *spread up* to the capillary ends”, with a “meniscus at the end of each microcapillary”. In addition, the Howitz references relies on diffusion and/or convection mechanisms to mix a

second liquid passing into the microcapillary with a first liquid into the flow channel, which requires a sufficient amount of target fluid in the microcapillary. The Howitz reference therefore requires a substantial amount of dead volume in each microcapillary, precluding formation of a virtual wall with minimal dead volume.

As previously set forth, the Columbus '313 reference and the Bjornson reference also fail to disclose the claimed invention. Columbus '313 describes apertures having a relatively long length and size, resulting in a dead volume that is significantly **larger** than one picoliter. For example, on page 9, lines 6-8, the Columbus '313 reference indicates that it is preferable for a liquid ingress aperture 27b in a flow control bridge to have a diameter of about 0.25 centimeters, which would result in a relatively large dead volume. In addition, the apertures 27 have a depth that is substantially *larger* than a diameter, resulting in a channel shape, in contrast to the claimed fluid interface ports, which have a disk shape.

In addition, the aperture 630 of Bjornson does not have a diameter that is substantially larger than a depth to create a disk-shaped aperture, as recited in independent claims 9 and 20. Moreover, in Bjornson, liquid in the reservoir 56 is forced *out* via the aperture 630 and into reservoir 142, in contrast to the claimed invention, which utilizes virtual wall fluid interface ports to inject fluid into a channel. The Bjornson reference does not disclose a fluid interface port in a side wall of a microchannel. Rather, the aperture 630 is formed in a reservoir 56 in Bjornson. There is no suggestion that the structure described in Bjornson would be suitable in a microchannel.

In addition, the liquid inlet aperture 46 in Columbus '451 also has a depth that is larger than the diameter, in contrast to the claimed invention. As specifically set forth in column 5, lines 29-34, the liquid inlet aperture 46 has a diameter of between about 1.0 mm and about 5.0 mm, which would result in a dead volume many times *larger* than one picoliter, and is incapable of forming a virtual wall, as required by the claimed invention.

None of the cited references disclose a fluid interface port capable of forming a virtual wall. The virtual wall forms a direct interface between the microchannel interior and the microchannel exterior, allowing direct access to the liquid in microchannel without introducing dead or unswept volume in the microchannel. Even if the devices in the cited references were

capable of forming menisci, the menisci would not form virtual walls to allow a direct interface between the microchannel interior and the microchannel exterior, allowing direct access to the liquid in microchannel without introducing dead or unswept volume in the microchannel. In contrast, the channels in the Heller reference, the McCormick reference, the Amigo reference, the Howitz reference, the Columbus '313 reference, the Columbus '451 reference, the Bjornson reference, the Swedberg reference and the Sundberg reference do not directly interface a microchannel to the environment surrounding the device. These channels also do not form a direct interface, but rather a long, indirect opening with a large dead volume.

The virtual wall of the claimed invention also serves to seal liquid inside of the microchannel through a range of pressures in the microchannel. There is no teaching or suggestion that liquid is sealed in the devices of the cited references.

As set forth in the Manual of Patent Examining Procedure 2143,

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.

The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

These criteria are not met in the current rejection. First, motivation to combine the references is lacking. For example in *In re Fulton*, 391 F.3d 1195, 73 USPQ2d 1141 (Fed. Cir. 2004), the court emphasized that the proper inquiry is "whether there is something in the prior art as a whole to suggest the *desirability*, and thus the obviousness, of making the combination...." In fact, the prior art teaches away from minimizing a virtual wall fluid interface port with minimal or zero dead volume to facilitate direct interfacing with a channel interior.

In addition, Applicants position that motivation is lacking is bolstered by the fact that the modifications proposed by the Examiner render the prior art invention being modified

unsatisfactory for its intended purpose, change the principles of operation of the device and require a substantial reconstruction and redesign of the elements. (See *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984), and *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959). If the devices of Heller and the other references were modified as suggested by the Examiner, they would be inoperable for its intended purpose, because the efficiency of the sample loading could be compromised by the smaller fluid interface port. For example, if the microcapillaries of Howitz were modified as suggested by the Examiner, diffusion of a dosed liquid in a target fluid within the microcapillary could not occur, as target fluid would not spread up to the ends of the microcapillary, as required by Howitz. Because the changes to the configuration of the capillaries of Howitz and application areas of Heller would require a substantial reconstruction and redesign of the elements, as well as a change in the basic principle under which the devices were designed to operate, the claimed invention is not obvious over the cited references.

The particular dimensions of the claimed fluid interface port define a structure that allows the claimed device to perform in a particular manner not disclosed in the prior art. In fact, were the interfacing components in the cited references to have the claimed dimensions, the operation of the prior art devices would be significantly altered.

Second, a reasonable expectation of success from the combination suggested by the Examiner is lacking. There is no indication that modifying the references to include a virtual wall fluid interface port of the claimed configuration and dimensions would be successful.

Finally, all the claim limitations are not taught or suggested by the prior art. As described above, even in combination, a virtual wall fluid interface port having minimal dead volume and the claimed configuration and dimensions is not disclosed or obvious from the prior art. In fact, the prior art teaches toward maximizing dead volume.

As described above, all pending claims distinguish patentably over the cited references. For at least these reasons, Applicants request that the rejections under 35 U.S.C. §103 be reconsidered and withdrawn. For at least the foregoing reasons, claims 1-45, 46-64 and 66-70 are patentable over the cited references and in condition for allowance.

CONCLUSION

In view of the above amendment, applicant believes the pending application is in condition for allowance. If a telephone conversation with Applicants' attorney would help expedite the prosecution of the above-identified application, the Examiner is urged to call the undersigned attorney at (617) 227-7400.

If any additional fee is due with this statement, please charge our Deposit Account No. 12-0080, under Order No. TGZ-001BRCE2, from which the undersigned is authorized to draw.

Dated: February 27, 2007

Respectfully submitted,

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